Algorithm 4: VIRTUAL: BC with virtual vertices

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...
ℓ ← 0
▷Forward phase
while cont = true do
    cont ← false
    ▷Forward-step kernel
    for each virtual vertex u_vir in parallel do
        u ← vmap[u_vir]
        if d[u] = ℓ then
1           for each v ∈ Γ_vir(u_vir) do
2               if d[v] = −1 then
                    d[v] ← ℓ + 1, cont ← true
                if d[v] = ℓ + 1 then σ[v] ←^atomic σ[v] + σ[u]
    ℓ ← ℓ + 1
...
▷Backward phase
while ℓ > 1 do
    ℓ ← ℓ − 1
    ▷Backward-step kernel
    for each virtual vertex u_vir in parallel do
        u ← vmap[u_vir]
        if d[u] = ℓ then
            sum ← 0
4           for each v ∈ Γ(u) do
5               if d[v] = ℓ + 1 then sum ← sum + δ[v]
6           δ[u] ←^atomic δ[u] + sum
▷Update bc values by using Equation (5)
...
```